DOCUMENT RESUME

ED 387 351 SE 056 817

AUTHOR Wiles, Clyde A., Ed.; Schoon, Kenneth J., Ed.
TITLE Mathematics Unit Plans. PACE '94.
INSTITUTION Gary Community School Corp., IN.; Indiana State Commission for Higher Education, Indianapolis.; Indiana Univ. Northwest, Gary.; Merrillville Community School Corp., IN.
SPONS AGENCY Eisenhower Program for Mathematics and Science Education (ED), Washington, DC.
PUB DATE 94
NOTE 50p.; For related documents, see SE 056 818-820.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Algebra; *Geometry; Lesson Plans; *Mathematics Instruction; *Problem Solving; Secondary Education; *Technology; Units of Study
IDENTIFIERS *Pre Algebra

ABSTRACT

This booklet contains mathematics unit plans for Algebra 1, Geometry, Math for Technology, Mathematical Problem Solving, and Pre-Algebra developed by PACE (Promoting Academic Excellence In Mathematics, Science & Technology for Workers of the 21st Century). Each unit plan contains suggested timing, objectives, skills to be acquired, workplace relationships, learning activities with suggested teaching strategies, evaluation techniques, and resources. The unit plans for Algebra 1 include the following: basic operations using rational numbers, solving linear equations, factoring polynomials, algebra in a plane, linear systems, statistics and linear and non-linear functions, graphing, inequalities, integers, and solving equations. The unit plans for Geometry are: estimating heights, Pythagorean theorem, and geometric measurements. The Math for Technology section contains: trigonometric ratios; ratio, proportion, and variation; and linear programming. The Mathematical Problem Solving units are: investing your money, measurement (building a brick wall), statistics, solving equations, and patterns. The Pre-Algebra section contains: percents and applications, ratio and proportion, introduction to statistics, introduction to probability, and formulas for measuring shapes of 2 and 3 dimensions. (MKR)

PACE '94

Mathematics Unit Plans

Clyde A. Wiles • Kenneth J. Schoon
Editors

PACE Promoting Academic Excellence In Mathematics, Science & Technology for Workers of the 21st Century.

Gary Community School Corporation
Merrillville Community School Corporation
Indiana University Northwest

PACE '94

Mathematics Unit Plans

Algebra I Units

Basic Operations Using Rational Numbers

Solving Linear Equations

Factoring Polynomials

Algebra in a Plane

Linear Systems

Statistics / Linear and Non-linear Functions

Graphing

Inequalities

Integers

Solving Equations

Planning group members:
Jerry Herochik, James McClain, Kathleen McCoy, Thomas Powell, Jr., Rachel. Cooper, Willye Cooper-Martin, Jackie. Gates, and Jack Trass

Unit name: **Basic operations using rational numbers**

Suggested time: **6-8 weeks**

Objectives

Concepts to be learned

Students will

1. know when and how to use a particular operation to solve a problem
2. understand the meaning of variables and how they are used.

Skills to be acquired

Students will

1. perform with calculators computations using proper order of operations for rational numbers.
2. use estimation to anticipate results, check results, and approximate.
3. perform heuristic problem solving.
4. solve applied problems.
5. evaluate and simplify variable expressions by applying the associative, commutative, and distributive properties.

Workplace relationships

Students will work effectively with team members to obtain results.

Learning activities / Teaching strategies to use

1. Solve computational problems using a calculator. Teacher demonstrates the sequence of steps for the proper use of the calculator
2. Explore when estimation skills are used. Whole group discussion focusing on situations, careers, amount, variety, and overestimation and underestimation
3. Estimate answers to fall in a given range; worksheets and estimation games like four-in-a-row where pairs or teams can play.
4. Solve non-routine problems; cooperative learning in groups of 2 or three members and whole group discussion of solutions.
5. Solve problems from real life and health careers (individually and cooperatively)
6. Learn the meaning of variable/ discovery technique using the game "What's my rule" and the "Think of a number activity." (THOAN).
7. Evaluate a variable expression (demonstration and worksheets).

Evaluation (other than paper and pencil exams)

1. Class participation
2. Oral presentations

Resources:

1. M.A.P.S. School and Mathematics Science Center Purdue University
2. *Essentials for High School Mathematics*, Houghton Mifflin, 1984.

Planning group members: Rachel Cooper, Willye Cooper-Martin, Jackie Gates, and Jack Trass

Unit name: **Solving Linear Equations** Suggested time: **4 weeks**

Objectives

Concepts to be learned

Students will

1. use properties of basic fundamental operations to solve first degree equations.
2. represent technical situations involving variable expressions.
3. translate technical English sentences to an equation.
4. solve single variable equations to find missing information.
5. analyze and solve verbal problems involving one or more numbers.
6. come to the understanding that the formula is a concise equation.

Skills to be acquired

Students will

1. work effectively with team members to solve problems which lead to equations.
2. use a calculator to perform operations to find the missing information in an equation.
3. check results to be sure the question of the problem has been answered.
4. use balance scales to insure understanding of the equation concept .

Workplace relationships

1. Physical therapists determine the rate of speed and the amount of time patients of various ages will spend on a stress machine.
2. Pharmacists use equations to determine the number of pills needed per month for X number of patients taking two pills a day.
3. Nutritionists determine the caloric, fat, and cholesterol content of meals for diabetic patients.
4. A team of interns checks and charts all vital signs of a trauma patient.
5. The manager of the hospital restaurant figures the cost of making coffee for a week.

Learning activities / Teaching strategies to use

1. Use the computer to solve equations of the type $X + B = C$, and $A X = C$ then have students solve type $AX + B = C$ without the computer..
2. Groups will use double pan balances to explore properties of equality and to solve equations.
3. Students will write formulas for work related situations.
4. Introduce problems that can be solved in a variety of ways and have students discuss them
5. Algebra tiles and other manipulatives will be used to help cross the bridge to the abstract world.
6. Have parent, who is a nurse, come in and demonstrate the immunization procedure.
7. Students will use the formula $P=100 + a/2$ to make a systolic blood pressure chart for themselves for the next 20 years.

Evaluation (other than paper and pencil exams)

1. Teacher observation
2. Interviews
3. Student projects (individual and groups)
4. Student presentations (individual and groups)
5. Portfolio

Resources:

Algebra structure and Method, Book 1 Houghton - Mifflin, 1992.
Algebra 1, Holt
North Central Regional Educational Laboratory

Planning group members: Rachel Cooper, Willye Cooper-Martin, Jackie Gates, and Jack Trass

Unit name: **Factoring Polynomials** Suggested time: **4 weeks**

Objectives

Concepts to be learned

Students will

1. find the product of two binomials
2. factor: trinomials, the difference of two squares, and trinomials containing two variables.
3. solve quadratic equations by factoring.
4. solve word problems dealing with even and odd integers.
5. work effectively with team members to obtain and use information.

Skills to be acquired

Students will

1. represent technical situations involving various quantities with expressions, equations, inequalities, and matrices.
2. apply rules of powers and roots to solve technical problems.

Workplace relationships

1. Hospital personnel collaborating on a patients case, progress and recovery.
2. A financial adviser establishes a budget for payment of hospital bill.
3. A hospital has overhead expenses and costs for stock and personnel and needs to know anticipated expenditures.

Learning activities / Teaching strategies to use

1. Working with shapes in two dimension.
2. Layout a particular floor of a hospital or clinic to maximize use of space and convenience to employees and patients.
3. Drawing to scale.

Evaluation (other than paper and pencil exams)

demonstration
portfolio
oral
homework

Resources:

Algebra 1, Houghton Mifflin--1992
Integrated Math, Houghton Mifflin--1995
CORD (Center for Occupational Research and Development) materials

Planning group members: Rachel Cooper, Willye Cooper-Martin, Jackie Gates, and Jack Trass

Unit name: **Algebra in a Plane** Suggested time: **4-6 weeks**

Objectives

Concepts to be learned

Students will

1. find and evaluate the absolute value of an algebraic expression containing one variable.
2. solve and graph equations with absolute value expressions.
3. find directed distances on a number line.
4. name coordinates of plotted points.
5. plot points given ordered pairs.
6. work effectively with team members to obtain and use information.

Skills to be acquired

Students will

1. graph linear and non-linear functions and inequalities to interpret status and trends.
2. define functions and or inequalities from a graph in order to obtain specific data and analyze alternatives.
3. make graphs, given specific data.

Workplace relationships

1. Charting a patient's progress by graphing
2. City Planning Department expanding the city limits of Gary
3. Developing costs associated with individual types of health care

Learning activities / Teaching strategies to Use

1. Measure an object and draw a scale model.
2. Draw to scale a map of a chosen city in Indiana.
3. Given algebra tiles build a rectangle with given length and width
   (x-1) (x-2)
4. Draw a picture, given a list of coordinates.

Evaluation (other than paper and pencil exams)

Homework
Portfolio
Demonstrations
Oral Presentations

Resources:

Algebra I, Houghton Mifflin, 1992
Integrated Math, Houghton, 1995
CORD (Center for Occupational Research and Development) materials

Planning group members: Rachel Cooper, Willye Cooper-Martin, Jackie Gates, and Jack Trass

Unit name: **Linear Systems** Suggested time: **4 weeks**

Objectives

Concepts to be learned

Students will

1. graph linear and non-linear functions and inequalities to interpret status and trends.
2. define functions and / or inequalities from a graph in order to obtain specific data and analyze alternatives.

Skill to be acquired

Students will solve systems of equations to aid in decision making

Workplace relationships

1. A buyer for the hospital wishes to determine the company which will supply linen for the hospital.
2. A dietician wishes to determine the amount of meat per serving depending upon the patient's weight.

Learning activities / Teaching strategies to use

1. Cooperative learning
2. Hands-on activities
3. Lecture
4. Problem-solving / Career awareness
5. Guest speakers
6. Independent research
7. Graphing and chart activities

Evaluation (other than paper and pencil exams)

1. Teacher observation
2. Interviews
3. Student projects (individual and groups)
4. Student presentations (individual and groups)

Resources:

Algebra Structure and Method Book 1 Houghton - Mifflin, 1992
Algebra 1, Holt
North Central Regional Educational Laboratory

Planning group members: Rachel Cooper, Willye Cooper-Martin, Jackie Gates, and Jack Trass

Unit name: **Statistics, Linear and Non-linear Functions**

Suggested time: **4 weeks**

Objectives:

Concepts to be learned

Students will:

1. graph linear and non-linear functions to interpret status and trends
2. define functions and / or inequalities from a graph in order to obtain specific data and analyze alternatives

Skills to be acquired

Students will:

1. Perform with calculators arithmetic computations, using proper order of operations for positive and negative integers, fractions, decimals, and percents.
2. Use estimations to anticipate results. Check results and approximations.
3. Work effectively with team members.

Workplace relationships

1. A cardiologist monitors the heart rate of a patient.
2. A nurse compares time and temperature on a patient's chart.

Learning Activities / Teaching Strategies to use

1. Cooperative learning
2. Hands-on activities
3. Lecture
4. Problem-solving / Career awareness
5. Guest speakers
6. Independent research
7. Graphing and chart activities

Evaluation (other than paper and pencil exams)

1. Teacher observation
2. Interviews
3. Student projects (individual and groups)
4. Student presentations (individual and groups)

Resources:

Algebra Structure and Method Book 1, Houghton - Mifflin, 1992..
Algebra 1, Holt.
North Central Regional Educational Laboratory.
CORD (Center for Occupational Research and Development) materials.

Planning group members: Rachel Cooper, Willye Cooper-Martin, Jackie Gates, and Jack Trass

Unit name: **Graphing** Suggested time: **3 weeks**

Objectives

Concepts to be learned

1. Graphing linear functions
2. Graphing lines parallel to the x- and y-axis
3. Slope of a line
4. Slopes of lines parallel and perpendicular to a given line
5. Distance between two points
6. Midpoint of a segment
7. Writing equations of linear functions
8. Using graphs of linear equations to solve problems and interpret data

Skills to be acquired

1. Given an ordered pair, the student will graph the point on a co-ordinate plane.
2. Given a linear equation, the student will graph by the following means: use of a table, with three points; the intercept method and point-slope method.
3. The student will graph and write horizontal and vertical lines.
4. The student will find the slope of a line by the following means: through two points; given an equation; given the graph of a line.
5. Given two points, the student will determine the length of the segment joining them.
6. Given two points, the student will find the point midway between them.
7. Given the equation of a line, the student will differentiate between standard form and slope-intercept form.
8. The student will write an equation of a line, given two points or given a point and the slope of a line.
9. The student will solve workplace relationship problems using the graphs of linear equations.

Workplace relationships

1. Carpentry: designing functional stair systems, plumbing and electrical systems; determining the pitch of a roof.
2. Manufacturing: operate and set up CNC milling machine
3. Drafting: CAD applications
4. Aerospace industry: navigation and piloting simulations
5. Economist: supply and demand models

Learning activities / Teaching strategies to use

Cooperative learning activity: Students in groups of four or five will stack a varying series of books of equal dimensions and lean a pvc pipe against the stack. At this time they will place a marble in the pipe to observe the changes of its velocity as the students alter the number of books in the stack. Students will continue this activity until they reach a conclusion regarding the slope of the pipe and the velocity of the marble. Following the activity, the students will be asked to report their findings. When this is complete, they will find the slope of a line given two points and using a geoboard and a rubber band. Students will change the location of their rubber bands and observe the changes in slope and then report their results. They will also be asked to theorize their findings. At the end of this exercise, each group will orally report their results.

Cooperative learning activity (two days):

Day one: Students will be separated into groups of 3-4 students. A graphing calculator will be assigned to each group. Each group will program their calculators for the graphing

function. Students will form lines in slope-intercept form. The students will observe the change in the graphs by altering the y-intercepts of each equation.

Day two: Students will observe the changes in the graphs of each equation by changing the slope of the lines. Students will be required to report their observations and describe the results.

Field trip: Students will visit Bethlehem Steel to observe an operating CNC milling machine. Upon return to classroom, the students will set up and operate a CNC milling machine, by drawing, writing codes, and running their programs.

All learning activities will require a written report discussing student findings.

Evaluation

35% Process measures: Homework, group work, written reports, and oral reports, attendance at Bethlehem Steel field trip

15% Performance measures: Each student will list their contributions to the group projects

35% Knowledge: Quizzes and tests

15% Portfolio weight: List of required competencies that student mastered, self-evaluation, reports on projects and group activities

Resources:

Houghton-Mifflin *Algebra, Structure and Method, Integrated Mathematics*, Columbus Pilot Site Integrated Algebra Program, Indiana Educator, Spring 1994, teacher contributions.

Planning group members:

Jerry Herochik, James McClain, Kathleen McCoy, and Thomas Powell, Jr.

Unit name: **Inequalities** Suggested time: **3 weeks**

Objectives

Concepts to be learned

1. Solving inequalities
2. Solving conjunctions and disjunctions
3. Evaluating expressions
4. Writing inequalities
5. Graphing inequalities (on both a number line and a co-ordinate plane)
6. Solving systems of inequalities

Skills to be acquired

1. Given two numbers, the student will write an inequality.
2. Given an inequality, the student will determine whether it is true or false.
3. Given an inequality, the student will find the solution set.
4. Given an inequality, the student will graph the solution set on a number line.
5. The student will represent the solution set of a given linear inequality by graphing.
6. Given the disjunction or conjunction of two inequalities, the student will find the solution set.

Workplace relationships

1. Manufacturing: sizing, tensile strength studies, stress tolerances, error analysis
2. Quality control: using conjunctions and disjunctions for acceptance or rejection
3. Air traffic control: graphing, conjunctions and disjunctions, radar interpretation
4. Economics: supply and demand models and curves, stock market activities, banking functions

Learning activities / Teaching strategies to use

Cooperative learning activity: Students will be given double pan balances and weights of different masses. Students will demonstrate the validity of the addition and subtraction properties of inequality. Groups of two students will be formed. Students will record and report their results.

Student project: Students will construct a model for buying and selling stocks at certain prices, illustrated using conjunctions and disjunctions.

Student project: Determine the break even point of a given fund raising activity.

Interdepartmental class project: Write a timeline for a given twenty year period of time.

Evaluation

25% Process measures: Homework, group work reports

25% Performance measures: Project participation and presentation. Students' stock portfolio will be evaluated on the basis of the amount of increase in stock value.

50% Knowledge: Quizzes and tests

Resources:

Algebra, Structure and Method, Integrated Mathematics, Houghton-Mifflin

Columbus Pilot Site Integrated Algebra Program

Indiana Educator, Spring 1994.

Planning group members:

Jerry Herochik, James McClain, Kathleen McCoy, and Thomas Powell, Jr.

Unit name: **Integers** Suggested time: **4 weeks**

Objectives

Concepts to be learned

1. The language of mathematics--order of operations
2. The meaning of negative numbers
3. Definition of non-positive and non-negative numbers
4. Why -a is not necessarily a negative number

Skills to be acquired

1. Given two integers, the student will add them.
2. Given two integers, the student will subtract them.
3. Given two integers, the student will multiply them.
4. Given two integers, the student will divide them.
5. Given an expression with two or more integers and any operation, the student will evaluate it.

Workplace relationships

1. Air conditioning/refrigeration: Monitoring temperature variance in chicken houses, meat storage.
2. Stock broker/banker: Calculating capital gains/losses from daily stock changes (either positive or negative).
3. Diver, Oceanographer, Geographer: Determining mean depth, altitude over non-uniform surfaces above and/or below sea level.
4. Electrician, electronics technician: Finding amplitudes of RF signals charted on an oscilloscope.
5. Tactical officer, US Navy: Finding firing solution for opposing naval vessels or aircraft.

Learning activities / Teaching strategies to use

Manipulative activity: Each student is given several round disks of two different colors, one color representing positive integers, the other representing negatives. By discovery, the students learn that a positive and negative balance out to zero, from that they learn the rules for integer addition.

Cooperative learning: Inform students that there is one temperature in both the Fahrenheit and Celsius scales that are equal. Have students work in small groups to determine the temperature by trial and error.

Outside activity: Give students a statistics sheet with which they can monitor gains and losses from their school's weekly football game. Ask students to calculate net yardages by team, by game, by quarter, and by player.

Evaluation

35% Process Measures: Homework, group work, attendance at one football game

25% Performance Measures: Observed appreciation of the applicability of integer operations, through survey; demonstrated mastery of statistics taking in a simulated football game.

40% Knowledge: Quizzes and Tests

0% Portfolio Weight. Mastery of integers is so incorporated into other units of Algebra I that if the portfolio contains anything at all, mastery is indicated.

Resources: Houghton-Mifflin *Algebra, Structure and Method, Integrated Mathematics*, Columbus Pilot Site Integrated Algebra Program, *Indiana Educator*, Spring 1994, *The Mathematics Teacher*, May 1986.

Planning group members:

Jerry Herochik, James McClain, Kathleen McCoy, and Thomas Powell, Jr.

Unit name: **Solving Equations** Suggested time: **5 weeks**

Objectives

Concepts to be learned

1. Determining the solution set of any first degree equation
2. Modeling and solving problems using equations.
3. Evaluating formulas

Skills to be acquired

1. Solving simple one-operation equations
2. Solving equations with variables on one side of an equals sign involving more than one operation.
3. Solving equations containing variables on both sides of an equals sign.
4. Solving equations using several transformations.
5. Applying these skills to solving real-world problems.

Workplace relationships

1. Retail: Solving problems involving cost, discounts, markup, and inventory control.
2. Building trades: Area, perimeter, and circumference problems.
3. Finance: Calculating simple interest, calculating wages and salary.
4. City Planning: Areas, boundaries.
5. Health Services: Dietary requirements, calculating calories burned and consumed, caloric content of foods, percent daily values of nutrients.

Learning activities / Teaching strategies to use

1. *Cooperative learning activity:* Each student in a group of three will be given a portion of a solution to a linear equation. By communicating, groups determine the logical order of steps to follow to solve the equation. The pieces are shuffled and given to a second group, a third group and so forth until each group has an opportunity to solve that particular equation. Then, solutions are compared and evaluated by the students to determine which is the best. Students will then write a report of their findings.
2. *Laboratory experience:* Students are given several objects of different masses, and a double pan balance. The students will be guided in making concrete examples of abstract equations that demonstrate the properties of equality. Groups should be no larger than three students.
3. *Cooperative learning activity:* Given a unit of unknown length, the students will solve for that unknown. Information given: total area of classroom. Tool given: a length of string equal to the unknown length.

Evaluation:

30% Process measures: Homework, group work, attendance at one Friday night football game
20% Performance measures: Project participation and presentation
30% Knowledge: Quizzes and tests
20% Portfolio weight

Resources: Houghton-Mifflin *Algebra, Structure and Method, Integrated Mathematics,* Columbus Pilot Site Integrated Algebra Program, *Indiana Educator,* Spring 1994.

Planning group members:

Jerry Herochik, James McClain, Kathleen McCoy, and Thomas Powell, Jr.

Geometry Units

Estimating Heights

Pythagorean Theorem

Geometric Measurements

Planning Group Members:

Faye Barnes, Linda M. Davis, and Mary Ann Sherman

Unit name: **Estimating Heights** Suggested time: **2 weeks**

Objectives

Concepts to be learned

Students will

1. recognize and utilize basic properties of two and three dimensional figures which will facilitate communication and decision making.
2. determine measures such as lengths and widths.

Skills to be acquired

Students will apply similarity to indirect measurement.

Workplace relationships

A contractor will use this technique to estimate heights of buildings and other tall items.

Learning activities / Teaching strategies to use

1. Students will be assigned to bring in 3 pictures of items taller than themselves with a common item in each picture. Students will be grouped together by threes or fours and guess the heights of objects in each others' pictures, they will record the measures. Students will then estimate the height in relation to the common item. (Points will be given for bringing in assigned items.)

2. Students will be taught the concept of similar triangles. Students will be given a worksheet related to similar triangles and they will work together to find the solution requested. Students will prepare a group presentation on their results.

3. Students will list 5 buildings in the area. Individually students will rank the buildings on their lists in order from shortest to tallest. Students will then discuss their lists and decide where Lew Wallace High School ranks on each list. Group participation credit will be given for each participant.

4. Each student will guess the height of Lew Wallace High School. Each group will agree on one estimation for the height of the school. Students, by groups, will use their knowledge of similar triangles to estimate the height of Lew Wallace High School. Students will present their findings to the class as a group, they will be assessed accordingly.

Evaluation (other than paper and pencil exams)

The evaluation process would also include a written group report. Upon completion of each group's presentation the exact height of the school would be revealed and students can do a self-assessment in regards to the actual answer.

Planning Group Members: Faye Barnes, Linda M. Davis and Mary Ann Sherman

Unit name: **Pythagorean Theorem** Suggested time:

Objectives

Concepts to be learned

1. Develop the Pythagorean Theorem by showing how the lengths of the sides of a right triangle are related.
2. Apply the Pythagorean theorem.

Skills to be acquired

1 Write the relationships between the sides of a right triangle.
2. Discover the Pythagorean theorem through the use of inductive reasoning.
3. State the Pythagorean theorem.
4. Use squares and square roots of numbers.
5. Utilize and apply concepts related to the Pythagorean theorem.
6. Problem-solving and logic skills

Workplace relationships

1. Fine arts technical drama majors: Building sets for a production.
2. Business management: Surveying a parcel of land to determine cost for development
3. Consumer application: Travel plans to go the scenic route one way (legs of a right triangle) and take the shortest route to return home (hypotenuse).

Learning activities / Teaching strategies to use

Lab Work	Application-based strategies
Using Manipulatives	Competency-based strategies
Problem Solving	Problem-solving / Critical thinking
4 - MAT	Cooperative learning

Evaluation

Checklists	Group work
Drawings	Written projects
Models	Self-checks

Resources

Geometry, Houston Mifflin, 1992
Integrated Mathematics Book, Houston Mifflin, 1995
Geometry for Decision Making, Southwestern, 1992

Planning Group Members: Faye Barnes, Linda M. Davis, and Mary Ann Sherman

Unit name: **Geometric Measurements** Suggested time:

Objectives

Concepts to be learned

Students will

1. recognize and utilize the basic properties of two and three dimensional figures to facilitate communications and decision making.
2. determine measures such as length, perimeter, area and volume as encountered in the workplace.

Skills to be acquired

Students will:

1. estimate lengths, perimeters, areas, and volume of geometric figures.
2. measure lengths, perimeters, areas and volume of geometric figures.
3. solve real-life problems using lengths, perimeters, areas and volume.

Workplace relationships

1. A masonry contractor checks to determine whether a foundation is square.
2. A package designer submits a proposal for tennis ball containers.
3. A veterinary assistant determines the amount of fluid retained by an animal
4. A contractor measures the space between a stove range and cabinet before cutting Formica to fit the space and hanging an exhaust hood.

Learning activities / Teaching strategies to use

Teacher will review and introduce students to units of the two systems of measurement (Metric and United States) using videos and transparencies

Students will

1. make models for units in both systems (cooperative learning groups)
2. compare metric units to U.S. units
3. estimate the length and height of several constructions and objects in the classroom.
4. decide what unit of measure a carpenter, nurse, computer programmer, chefs, etc. may use on their jobs.
5. give an everyday example of needing an exact length and an example of needing only an estimated length and explain why the needs are different.

Area

Teacher will review and introduce concepts of area and perimeter using manipulatives and transparencies.

Students will:

1. estimate the area of different states and body of waters in the United States using a map of the United States.
2. determine the:
   a. number of 2 ft. by 3 ft. posters that will cover a 10 ft. wide by 8 ft. high wall.
   b. number of vertically oriented posters.
   c. number of horizontally oriented posters.
   d. combination of vertical and horizontal posters.
3. write the above activities in Metric and U.S. units.
4. brainstorm methods of estimating areas.
5. write the area and perimeter of different rooms in a floor plan.

Volume

Teacher will introduce and review concepts of volume using models of prisms and cylinders
Students will:

1. identify the bases of several prisms after examining them.
2. discover the base of a prism can be any regular polygon after examining different prisms.
3. determine how many fish can be bought for an aquarium, if it is filled to a depth of 11 in., and one fish should be bought for one gallon water.
4. decide which will increase the volume of a cylinder more doubling its height or doubling its radius.
5. find the dimensions of a box given the number of items that will fit in the box and their thickness and diameter.
   a. find the volume and diameter
   b. find the surface area of the box.
   c. find the ratio of the surface area to the volume.

Group activity

1. Collect data on the dimensions of different sizes and shapes of cans. Record your data in the first three rows of a table.
2. Complete the table by finding each can's surface area (S.A.), volume, and the surface area/volume ratio.
3. For which can is the surface area to volume ratio the smallest? the largest? Sketch these cans and label their dimensions.
4. Compare your results with those of your classmates. How do size and shape affect the surface area/volume ratio?
5. What recommendations would you make to the manufacturers of the cans you measured?

Evaluation (other than paper and pencil exams)

Draw an eight-sided figure that has a perimeter of 42 cm. Use dot paper or graph paper if necessary. What is the area of the figure? Is your answer an estimate or is it exact?

Resources:

Integrated Mathematics 1, Rubenstein, Craine & Butts, Houston Mifflin
Applied Mathematics Unit 7 Working With Shapes in Two Dimensions, CORD (Center for Occupational Research and Development)
The Mathematics Teacher, "Videos, Transparencies & Computers," October 1993.
Geometry, Brown, Jurgenson, Houston Mifflin

Planning Group Members: Faye Barnes, Linda M. Davis, and Mary Ann Sherman

Math for Technology

Merrillville High School

Philosophy: It is intended that these units for the Math for Technology course leave the students with a clear understanding of how the mathematics of each unit is utilized in one of the three clusters offered at Merrillville High School. To accomplish this, several activities, resources, and examples from the cluster areas are used exclusively within each unit. The utilization of outside personnel to give validity to the application of the material is a crucial component of this objective. Since this is included within the Tech Prep area, the students learning and evaluation will be done with an emphasis on hands-on activities and projects. Group work and presentations will also be emphasized.

Trigonometric ratios

Ratio, Proportion, Variation

Linear Programming

Planning Group Members:
Violet Schmuck, Alan Branda, and Mike Al-Hajar

Unit name: **Trigonometric Ratios** Suggested time: **3 weeks**

Objectives

Concepts to be learned

Trigonometric terms and definitions; wavelength, amplitude, phase shift, period; correlation between trigonometry and different career fields.

Skills to be acquired

Apply sine, cosine, tangent to determine lengths of sides and unknown angles of right triangles.
Demonstrate variations caused by amplitude, period, and phase shift changes.
Recognize relationship between triangle trigonometry and graphs of trigonometric functions.

Workplace relationships

Sound waves at a rock concert.
T.V. technician utilizes an oscilloscope to determine the cause of vertical fluttering.
Measurement of sound to determine machine maintenance.
Construction of trusses for support of structures.

Learning activities / Teaching strategies to use

Tuning fork with two tubes to demonstrate sound waves.
Build a bridge utilizing wood and glue to support a pre-determined weight. Calculate force on all pieces used.

Evaluation (other than paper and pencil exams)

Grade bridge project in four ways.

1. Whether it supports specified weight.
2. Teacher evaluation of students' remaining on task.
3. Other members of group evaluation.
4. Grade on presentation to the class or other classes.

Paper and pencil performance of concepts.
Group work on other activities with presentations.

Resources

Wood, glue, cutting device, scales, tuning forks, tubes, computer lab,

Planning Group Members: Violet Schmuck, Alan Branda, and Mike Al-Hajar

Day 1 Students will work in groups of 3. After striking a tuning fork with same intensity, they will listen to the sound through tubes. The length of the tubes are recorded for the above levels. The student will graphs their records to see waves. There will be an application of the idea of amplitude to decibel readings for noise limits.

Objectives: Students will realize physical world relationships can be explained by use of wave graphs. Thought provoking: What in the world does this have to do with building a bridge? Students will fill in charts for sine and cosine from 0 to 360 degrees varying by 15 by using calculators.

Day 2 Students will use information gathered to graph points on a two dimensional graph, both sine and cosine waves. After being introduced to a right triangle, students will be led to the ratio of sine 30 degrees is the ratio of the two sides of a triangle. Their assignment will be to discover the two rules to get all the values they discovered on their tables. They will be asked to do this in groups and they will be asked to present their findings to the class the next day both orally and in writing.

Objectives: Students will relate trig functions to their ratios in triangles and their graphs.

Day 3 Academic learning. Students will be given examples of solving right triangles using the trig ratios. They will be asked to find the sine, cosine, tangent, and inverse sine, cosine, and tangent to determine unknown values. They will be given a practice paper and be reminded of a quiz the next day.

Objectives: Students will apply trig ratios to determine standard problems to find unknown values.

Day 4 Students will be asked to display knowledge on board for a review then asked to show knowledge learned thus far on a paper and pencil evaluation.

Objectives: Students will be able to perform at 70% mastery on paper and pencil instrument.

Day 5 After getting their quiz back, the students will be exposed to a guest speaker to discuss all the real world applications of trigonometric ratios, after which they will be introduced to their bridge building project and assigned their groups. Grouping will be done by gender and by performance on quiz.

Objectives: Students will get feedback on quiz performance plus get validity to concept of real world applications of trig functions.

Day 6-10 Students will be given the basic rules of the bridge building project. They will be shown basic designs to choose to build a bridge that will hold a minimum of x amount of weight. They will be given the strength of the materials they are using plus some examples of how to compute the forces on the different parts of the bridge. It should be noted that the word tension be used instead of forces so the students are not scared away by the physics. They will be given deadlines as to completion of the

1. first side
2. second side
3. completed bridge
4. presentation to class or other classes

They will be evaluated on their group work plus whether their bridge holds up to the specified weight.

Objectives: Students see applications of trig functions to construction of structures.

Day 11-15 Examples of applications of trigonometry in the fields of carpentry, electronics, drafting, and other related fields will be given this week. Other resource personnel will be utilized to introduce the material and also to supply examples and problems. Teacher will emphasize wavelength, phase shift, amplitude, and other related concepts to the graphs of sine and cosine. Computers, wave machine, and an oscilloscope will be some of hands on devices used by students to help develop these concepts.

Objectives: Students will show awareness of application of trigonometry in several different fields. They will demonstrate their awareness by writing a paper at the end of the week which will include at least one example of an application of trigonometry which is similar to something they have been exposed to during the week.

EVALUATION SUMMARY OF UNIT

Goals

1. To become familiar with the trigonometric functions and terminology used.
2. To apply trigonometric ratios in both abstract situations and in project development.
3. To become aware of the many different fields in technology which utilize trig ratios and how they are used.

Objectives

1. The student will be able to apply trigonometric ratios to solve for unknown values in right triangles.
2. The student will be able to graph the sine and cosine functions.
3. Students will complete a bridge which will hold a specified amount of weight utilizing trig ratios to compute forces used.
4. Students will describe how trig ratios are used in various fields with at least one original example of their use.

Process Measures

1. Work in groups to graph sine and cosine waves.
2. Work in groups to determine sine and cosine ratios.
3. Complete charts on trig ratios using calculator.
4. Use trig ratios to find unknown values.
5. Will attend and listen respectfully to demonstrations by both teacher and other resource personnel as to the applications of trig ratios to different occupations.

Performance Measure

1. Measure the length of a sound wave generated by a tuning fork.
2. Build a bridge using wood, glue, and trig ratios.
3. Give oral presentation to the class on results of bridge building project.
4. Give oral presentation to the class on ratio of sides of triangle to get trig values.
5. Demonstrate model of trig used in an occupational situation.

Knowledge measures

Demonstrate 70% mastery on paper and pencil evaluation of knowledge of using trig ratios to determine unknown values of a right triangle.

Unit name: **Ratio and Proportion** Suggested time: **2 weeks**

Objectives

Concepts to be learned

Rational expressions; proportions, inverse, direct, and joint variation.

Skills to be acquired.

Construct ratios, solve proportions, and recognize and apply the principles of direct and inverse variations found in the health fields.

Workplace relationships

Nursing-determining the dosage depending on weight.
Lab technician-calibrating machinery using ratios.
Radiologist-using proportion to position for x-rays.
Medical assistant-giving suggestions
Child Care-determining proper food intake.
Dietician-calculating calorie intake/usage.

Learning activities / Teaching strategies to use

Take pulse (6 seconds, 10 seconds, 15 seconds). First standing, then after a little exercise.
Calorie intake analysis. Exercise analysis to see if either affects the weight of the individual.
Guest speaker to discuss different health fields.
Field trip to IUN health training facilities.

Evaluation (other than paper and pencil exams)

Project grade on calorie/exercise analysis.
Paper and pencil evaluation on concept formation.
Presentation utilizing a survey, research, or experiment illustrating all three types of variation.

Day 1 Students will take standing pulse in 6 second, 10 second, and 15 second intervals. Then they will convert the measurements to beats per minute. After this they will walk to the Fitness Center and immediately take their pulse again at the same intervals. Then the students will do step aerobics and take their pulses again. After all measurements are taken and converted to beats per minute, the students will graph their results.

Objective: Students will calculate their resting and active pulse rate using ratios and proportions. Students will graph their various pulse rates.

Day 2 Students will be exposed to a guest speaker to discuss math needs in health related fields. Their own graph results from previous day will be discussed.

Objective: Students will see use of math in health related fields.

Day 3 Students will record food eaten for past three days and convert to total calories consumed. (This will have started with Day 1 activity for this unit.) Then they will record their activity for past three days and convert it to calories used. By comparison they will determine if they should have gained or lost weight. Students will check the accuracy of figures by comparing it with their actual weight loss or gain. (Students will privately weight themselves while at the fitness center on Day 1 activity and again at conclusion of this activity and only report actual gain or loss therefore preserving privacy.)

Objective: Students will collect and analyze data regarding calorie intake and use.

Day 4 Students will measure a distance for walking. They will then measure the time it takes to

walk the distance. Their rates will be converted to miles/hour for walking. The rate of speed of the fastest world runner will be calculated for a distance of 20 feet. A distance of 20 feet will be measured. Volunteer students will be challenged to match his time.

Objective: Students will be able to convert different rates of speed for comparison.

Day 5 After discussion of examples of direct, inverse, and joint variations, students will suggest other examples of these variations. Students will prove or disprove their suggestions by use of survey means or research.

Objective: Students will choose and verify real world situations in which direct, inverse, and joint variations apply. Students will calculate direct, inverse and joint variation.

Day 6 Students will participate in a field trip to IUN.

Objective: Students will spend one day investigating health careers.

EVALUATION SUMMARY OF UNIT

Goals

1. Students will apply ratios and proportions to health related fields.
2. Students will develop an awareness of different health fields and the corresponding math needed for these fields.

Objectives

1. Students will calculate their resting and active pulse rates using ratios and proportions.
2. Students will graph their various pulse rates.
3. Students will see use of math in health related fields.
4. Students will collect and analyze data regarding calorie intake and use.
5. Students will be able to convert different rates of speed for comparison.
6. Students will choose and verify real world situations in which direct, inverse, and joint variations apply.
7. Students will calculate direct, inverse, and joint variation.
8. Students will spend one day investigating health careers.

Process Measures

1. Graphing of individual pulse rates.
2. Analyze statistics of calorie intake and use.
3. Attendance and behavior for field trips.
4. Attention and behavior for guest speaker.

Performance Measures

1. The research or surveys for the real world situations with joint, direct, and inverse variation.

Knowledge Measures

Quiz

Portfolios:

1. Personal chart and graph of pulse rates.
2. Statistical analysis of calorie intake and use.

Resources

Fitness center. Guest Speakers. IUN facilities.

Planning Group Members: Violet Schmuck, Alan Branda, and Mike Al-Hajar

Unit name: **Linear Programming** Suggested time: **2 weeks**

Objectives

Concepts to be learned

Linear inequalities; linear programming; correlation between functions and their graphs.

Skills to be acquired

Design inequalities and use their graphs to obtain specific data and analyze alternatives.
Solve systems of equations to aid in decision making.

Workplace relationships

Manager decides how many of each product to produce to maximize profit.
Business owner determines whether to continue a product line.

Learning activities / Teaching strategies to use

Participate in M&M activity where student uses resource pieces to create new groups to sell to class members. Guest speaker to discuss linear programming applications in the real world.
Group work on solving a linear programming problem which includes a presentation to the class.

Evaluation (other than paper and pencil exams)

Number of tokens gained in projects. Written summary of strategy used to design new candy groups.
Paper and pencil evaluation of concept formation.
Clearness and accuracy of presentation.

Day 1 Students will be given bags of M&Ms to determine color distribution in each bag. After counting each color, as a group we will vote on the favorite colors. Then a value will be put on each color which will indicate how many tokens it will cost. The students will then be introduced to the project. This includes repackaging the candies into plastic bags to be resold to their classmates. They will purchase the candies for half of their token value, then resell them at whatever the market cost is for these combinations. To keep it simpler, they can only produce two different types of bags and these must contain at least one candy of each color.

Day 2 After finishing this activity, the students will be introduced to representation of this model with linear inequalities to show the constraints on their colors, along with the graphs of these functions to show corner points. This will be done in a computer lab on the mathematics exploration toolkit program. They will then be responsible to do another project much like this one only with peanut M&Ms including the graphical representation of their experience. This will be turned in the end of the next period.

Day 3 Students will finish activity from the previous day.

Day 4 A guest speaker from the business community will come to discuss mathematical applications to linear programming in the business world.

Day 5 Students will be given examples of how to work the linear programming problems in the textbook, then after grouping them in pairs, they are to practice working on these problems.

Day 6 Students will be given opportunity to explain their problems. They will be exposed to project requirements for their presentation for the class, after which they will be given the rest of

the period to work on and prepare their presentation.

Day 7 Continue working on project from the previous day.

Day 8 Videotaped presentations to class.

Day 9 Quiz individually on linear programming.

Day 10 Feedback on quiz performance. Play videotaped presentations.

EVALUATION SUMMARY OF UNIT

Goals

1. To become familiar with the use of linear programming and the terms involved.
2. To become more familiar with the use of a graphing program to aid in problem solving.
3. To become aware of applications of linear programming in the real world.
4. To become more experienced at giving presentations.

Objectives

1. The student will be able to apply linear programming to both abstract problems and projects.
2. The student will be able to graph linear inequalities using mathematics exploration toolkit including corner points.
3. The student will be able to work in pairs to prepare a presentation showing use of linear programming.
4. Student will demonstrate proper manners during guest speakers presentation.

Process measures

1. Work in groups to solve linear programming problems.
2. Show graphical representation of linear inequalities.
3. Demonstrate appropriate manners during speaker.

Performance measures

1. Complete M&M project including graph.
2. Give oral presentation to the class explaining linear programming problem out of textbook.

Knowledge measures

1. Demonstrate 70% mastery on paper and pencil evaluation of knowledge of linear programming and how it is used in the work force.

Resources

M&M candies. Both plain and peanut. Sandwich bags and ties.
Guest speaker.
Overhead projector, poster board, and various other visual aid materials which will help students in giving presentation.

Planning Group Members: Violet Schmuck, Alan Branda, and Mike Al-Hajar

Mathematical Problem Solving

Investing Your Money

Measurement (Building a Brick Wall)

Statistics ("Do The Right Thing" Deli)

Solving Equations

Patterns

Planning Group Members:

Lydia Colaire, Judy Tonk, and Gene Giorgio.

Unit name: **Investing Your Money** Suggested time: **2-3 weeks**

Objectives

Concepts to be learned

Meaning of percent, rounding, simple interest, compound interest, interpreting tables, creating tables, graphing on the coordinate plane, identifying types of savings accounts

Skills to be acquired

Identifying and collecting data, using a calculator, operations on percents, rounding to the nearest penny, graphing data, calculating simple interest, calculating compound interest by steps

Workplace relationships

Investment counselors and accountants would use these skills

Learning activities / teaching strategies to use

1. Have students solve a simple interest problem in groups and then have the students explain different methods used and answers found. (1 day)
2. Have students solve a compound interest problem in groups and then have the students explain different methods used and answers found. (1 day)
3. Presentation on compound and simple interest. Assign student project of a visit to or contact with a local bank or S&L institution to find information on various types of savings accounts. The report must include
   a. name of institution;
   b. types of accounts available;
   c. rate of interest for each account;
   d. minimum balance requirements;
   e. how interest is compounded;
   f. when interest is paid. Report is due in 7 class days.

(1 day)

4. Exploring and explaining Cartesian graphing with appropriate examples. (2 days)
5. Activities to teach use of graphing calculator and/or computer. (2 days)
6. Give the students 2 or 3 compound interest accounts and have them graph the accumulated amount vs. time period. (1 day)
7. Compare and interpret results from the graphs produced the day before. Critical assignment: Given a compound interest situation, have students graph the information on a using time vs. accumulated money. (1 day)
8. Investigation of what happens in a compound interest situation when principal and rate are fixed and the number of times of compounding increases for a fixed time period of 5 years. (1 day)
9. Turn in project reports and conduct general class discussion on results. (1 day)

Evaluation

30% student group work gathered from teacher observation
30% individual student work and project work
30% written test and quizzes
10% critical assignment

Resources: *Mathematics of Money*, Southwestern Publishing, 1992

Planning Group Members: Gene Giorgio, Judy Tonk, and Lydia Colaire

Unit Name: **Measurement (Building a Brick Wall)**

Suggested time: **2 weeks**

Goals: 1. Learning volume and linear measures
2. Use previously learned knowledge to solve unfamiliar problems
3. To communicate solutions to each other

Objectives

Concept to be learned

1. Meaning of area and volume

Skills to be acquired

1. Measuring with rulers and other instruments
2. Communicating mathematical ideas
3. Using a calculator productively
4. Gathering pertinent data

Workplace relationships: Contractor, estimator

Learning activities / teaching strategies to use

1. Divide the class into groups of three. Give each group a brick. Ask them to measure it in as many ways as they can and record their information. Discuss different units of measure and decide on using the metric system. Have the groups record results in a log which they will maintain for the entire unit. (1 day)
2. Discuss volume of their brick by asking them how much clay would it take to make this brick? Demonstrate volume by filling up a paper model of a brick with cubic centimeters. Have the students experiment finding volume by filling up different size paper models of bricks. This will lead to V = lwh. (1 day)
3. Present problems to students asking them "what is the least number of bricks needed to make a wall 3 m by 5 m ?" Lead a discussion and come to a consensus of how much distance between the layers of bricks. Have students draw a diagram of the wall and explain their solution in their log. (1 day)
4. Have the students do the same problem using a different method and record the solution in their log. (1 day)
5. Estimate the total weight of the wall and give a detailed solution in their log. (1 day)
6. Compute the cost of building the wall including materials and labor. Advise students they need to find the cost of labor and all the materials involved. Put the results in their log and hand in entire log in two days. (2 days)

Evaluation (other than paper and pencil exams)

60% log report
40% teacher observation of group participation

Resources

A Downpour of Math Lab Experiments by William Ewbank, 1969, Eastern Michigan University

Planning Group Members: Gene Giorgio, Judy Tonk, and Lydia Colaire

Unit name: **Statistics ("Do The Right Thing" Deli)**

Suggested time: **2 weeks**

Goals: Acquaint the students with the use of statistical surveys to solve a problem they might encounter in marketing.

Objectives

Concepts to be learned

1. Use of proportions
2. Use of statistical surveys
3. Importance of the mean
4. Use of random sampling

Skills to be acquired

1. Planning and conducting surveys
2. Drawing frequency diagrams.
3. Making predictions
4. Writing reports using data analysis

Workplace relationships: Advertising and Marketing

Learning activities / teaching strategies to use

PROBLEM: Gino is opening a deli at 2nd Ave and Grand Blvd. He wants to set it up so Wirt students will spend their money there. Prepare a list of items Gino should put on the menu.

1. Introductory presentation on surveys and their use. (1 day)
2. Break into groups to decide what questions to put on the survey. Come back together as a class to come to consensus on questions for survey. (1 day)
3. Discussion on how survey will be administered. This will lead to the "sampling" concept. Have students do "bean" activity. (1 day)

   BEAN ACTIVITY: In groups of two have students:
   1. Pour a bag of beans into a container.
   2. Take out a handful of beans, mark them all, and record how many you marked.
   3. Put the beans back in the container. Mix the beans well.
   4. Take out another handful of beans. Record the total number of beans in the sample and how many are marked.
   5. Use a proportion to estimate the total number of beans in the container.

      $$\frac{\text{marked beans picked}}{\text{total beans picked}} = \frac{\text{total beans marked}}{x}$$

   6. Repeat steps 3, 4, and 5 four times, to get five estimates in all.
   7. Find the mean of your five estimates.
   8. Count all the beans in the container. Compare your count with your estimates and your mean.
   9. What do you think would happen to the mean if you repeated steps 3, 4, and 5 one hundred times?
4. Using the results of the bean activity have students come to consensus through guided group discussion that whatever number of students they survey, they can calculate preferences of the entire student body. (1 day)
5. Guided discussion on how much accuracy is desired and then decide on the size of the sample for the survey. Type up survey, run off as many copies as needed and distribute at lunch time. (1 day)
6. Tabulate results and prepare frequency tables for each group. Convert to percentages. Compute the mean of the percentages. Each student will write a report to Gino using the results. This report must be ready for the following class day. (1 day)

7. Break into groups to critique and proofread each other's report, rewrite and hand in revised reports the next day. (1 day)

Evaluation: 60% written report: A clearly written analysis of the data
Types of predictions and recommendations
20% teacher observations on the creation and distributions of survey
20% written test on procedure of sampling populations

Resources: *Integrated Mathematics1*, Houghton-Mifflin, 1995

Planning Group Members: Gene Giorgio, Judy Tonk, and Lydia Colaire

Unit Name: **Solving Equations** Suggested time: **2 weeks**

Goal: Using equations to solve problems

Objectives: 1. To use variables correctly
2. To evaluate numerical/algebraic expressions
3. Translate verbal clauses into numerical/algebraic expressions
4. Translate verbal sentences into numerical/algebraic equations
5. Solve "story problems" using the five-step method

Workplace relationships: Computer programmer, engineer

Learning activities/Teaching strategies to use

1. Presentation on order of operations including exponentiation and using the calculator. Break into groups of 2 or 3. Groups work on "evaluating numerical expressions problems". Finish at home (1 day)
2. Presentation on the meaning of grouping symbols. Groups evaluate expressions with grouping symbols. Finish at home. (1 day)
3. Presentation on the meaning of variables and evaluating algebraic expressions. Groups evaluate algebraic expressions. Finish at home. (1 day)
4. Presentation of solving simple linear equations in one variable. Include the "Guess and Check" method as well as using inverse operations. Groups solve equations. Finish at home. (2 to 3 days)
5. Presentation on translating verbal clauses into numeric/algebraic expressions. Groups work on such problems. Finish at home. (1 day)
6. Presentation on translating verbal sentences into equations. Group work on such problems. Finish at home. (1 day)
7. Presentation on the 5-step Story Problem Solving Method. Groups work on such problems. (2 to 3 days)
8. Students break into groups. Each student is given a sheet of story problems. There should be as many problems as groups. Each group is assigned randomly just one problem. They work out a solution for this problem. The next day each group will present their solutions to the class. Every student should think about all the problems before the next day. (2 to 3 days)

Assessment

30% - group presentation
20% - quizzes
30% - test including a few of the problems in the presentations
20% - teacher observation of group work

Resources: *Pre-Algebra : An Accelerated Course*, Houghton-Miflin , 1985

Planning Group Members: Gene Giorgio, Judy Tonk, and Lydia Colaire

Unit name: **Patterns** Suggested time **2 weeks.**

Goals: 1. To enable students to develop and apply the strategy of looking for patterns, in solving problems by stock brokers, in agriculture to looking at locust swarms, in quality control to look at minimum/maximum productivity.
2. To enable students to recognize and learn to see what is appropriate as they justify answers and solution processes in the solving of problems, using previous knowledge and facts to solve an unfamiliar situation.

Objectives: 1. Find the nth term of a geometric and arithmetic sequence.
2. Find the sum of the first n terms of arithmetic sequences.

Workplace relationships: Taxi cab fares, banking tables, insurance.

Learning activities/Teaching strategies to use:
Students may work solo the first 10 to 13 minutes and then in twos the rest of the period.

ARITHMETIC SEQUENCES.....GROWTH AT A CONSTANT RATE.

1. TEACHER: Show picture of Carl Fredrich Gauss. Talk about him. Gauss was born in 1777 and died in 1855. When he was 10 years old, his math teacher asked his class to add all the whole numbers from 1 to 100. The teacher thought that it would take a long time for anyone to figure the correct answer, but within seconds, Gauss was finished and had correct answer. Show on board or use transparency. 1+2+3+4+5.....+99+100. Ask class to explain how Gauss did it. Allow students time to work on their own before giving the answer. Rather than adding the numbers in order, he added pairs from ends inward (1+100=101, 2+99=101...50+51=101). 50x101 = 5,050. Gauss had found out a short cut for finding the sum of the terms of an arithmetic sequence on his own. He grew up to become the leading mathematician of his time.

2. TEACHER: One hundred years ago, the typical weekly wage was about $12.00. How much would someone get per hour if he/she worked 40 hours per week?

   Suppose someone hired you for 40 hours with pay as follows: 30¢ for the first hour, 35¢ for the second hour, and an additional 5¢ for every hour you worked. How much money would you get for the week? (Let students work on own to solve problem).
   OBVIOUS WAY: Write out 40 terms and add in order.
   BETTER WAY: Look at earnings for eight hours, rather than adding eight numbers in order, write them twice (in pairs from ends inward) using Gauss theory.

30	35	40	45	50	55	60	65
+65	+60	+55	+50	+45	+40	+35	+30

   Because each of the eight sums is the same (ninety-five cents) we can simply multiply by eight, 8 x .95 = $7.60, and divide by two to find the answer: 7.60/2 = $3.80.

   Although this method is not especially practical for finding the earnings for the first eight hours, it is very useful for finding the earnings for longer periods of time. To use this method, however, we need to know what the last term being added is. To see how we can find without writing out all of the terms, look at the following pattern.

   1st hour 30, 2nd hour 30 + 5, 3rd hour 30 + 2x5, 4th hour 30 + 3x5, 5th hour 30 + 4x5, and so on.

Find the fortieth hour (30 + 39 x5 = 225). With this, we can write the following:

30	35	40	.....	220	225
+225	+220	+215		+35	+ 30

How much money would you make for the week? (40 x 255 = $\frac{10,200}{2}$ = 5,100; $51.00)

What would pay be for a year, supposing it was for fifty 40-hour weeks? ($100,550)

3. FIBONACCI SEQUENCE

TEACHER: Put a large card above front board. Have students write numbers from 1 - 10 in a column on their page. Have another student come to board and write two two-digit numbers while you face the class. Have students copy the numbers from the board on the first two lines of their numbered column. Student who chose numbers should erase them. Have students add the first two numbers and write the sum on the third line, continuing with the same for the 4th line. While class is absorbed find out the seventh number by asking student to tell what number is on the seventh line, saying that this was to serve as a check to see if everyone was on the right track. Ask students to find sum of ten numbers and while they are doing this multiply the seventh number by eleven and put correct answer on card, with number facing the wall.

Ask students to check their work, ask them if the final answer depends on the two numbers originally chosen. Show kids the answer on back of card, and have them come up with proof of why this works.

Hint: Have students represent first and second number as a and b. Find the pattern and the relate to real life examples like sun flower or do research on Fibonacci and Lucas numbers. Have them write report on findings.

4. COUNTING SQUARES

RESOURCE: CLASSROOM AIDS AND ACTIVITIES, NUMERICAL CONCEPTS.

Problem: Find the total number of squares on a checkerboard.

TEACHER: Do activity of having students fold square piece of paper, several times, then look for pattern in this order: number of folds, number of 1 x 1 squares, and total number of squares before attempting bigger problem. Hopefully, students should see relationship of folds to number of 1 x 1 squares as n squared, where n represent folds/ DIVISIONS. Also, the total number of squares as the addition of successive 1x1 squares. THUS THE NUMBER OF SQUARES OF ALL SIZES FOR N SUBDIVISIONS IS THE SUM OF THE SQUARES OF THE FIRST N COUNTING NUMBERS.

Example:	Number of folds	1	2	3
	Number of 1x1 SQUARES	1	4	9
	Total number of all squares	1	5	14

The following problems, 5 and 6 came from COLLEGE MATH EDUCATION CLASS.

5. Problem: This is a problem about a high school and that favorite storage area, the high school locker. At Gauss High there are 1000 students and 1000 lockers numbered 1 - 1000. At the beginning of our story, all the lockers are closed, then the first student comes by and opens

every locker. Following the first student , the second student goes along and closes every second locker. The third student changes the state (if the locker is open, she closes it; if the locker is closed, she opens it) of every third locker. The fourth student changes the state of every fourth locker, etc. Finally, the thousandth student changes the state of the thousandth locker. When the last student changes the state of the last locker, which lockers are open? (answer: perfect square less than 1000).

6. Problem: At 3:20 p.m. a jeweler set three antique clocks to the correct time. The next afternoon at 3:20 he found that one clock was correct, one was 2 minutes slow and one was 2 minutes fast. At those rates, how long will it take before all three clocks show 3:20 again? (answer: 360 days)

RESOURCE..... *A Teacher's Guide Mathematics: A Human Endeavor,* Second Edition. Harold Jacobs. For problems: 1,2,3.

Evaluation: 1. Have students keep a log record and write what they are doing.
2. 15 minutes of each hour have students report their findings.
3. Assign points for active work participation each day.
4. All these activities are suitable for the spread sheet program. Have students talk about their conclusions.

Planning Group Members: Lydia Colaire, Judy Tonk, and Gene Giorgio.

Pre-Algebra

Percents and Applications

Ratio & Proportions

Introduction to Statistics

Introduction to Probability

Formulas for Measuring Shapes of 2 and 3 Dimensions

Each unit incorporates these skills:

Explaining the thought process in writing or orally when given a problem-solving situation.
Writing number sentences to aid in problem-solving.
Checking for reasonableness of answers.
Finding solution sets.
Using the calculator.

Planning Group Members:

Deborah Abrahamson, Ruth Hairston, Cheryl Johnson, Rita Magee, and Patricia Presley

Unit name: **Percents and Applications** Suggested time: **3 weeks**

Objectives

Concepts to be learned

Students will

1. Convert numbers to different forms; from decimals and fractions to percents and from percents to decimals and fractions.
2. Solve the three types of percent problems.
3. Solve problems dealing with percent of increase or percent of decrease.

Skills to be acquired

Students will

1. Use graph paper to model percents.
2. Express fractions with denominators of 5, 10, 20, 25, 50, 100 as percents.
3. Express whole numbers as percents.
4. Change decimals and fractions to percents, and percents to decimals and fractions.
5. Change fraction percents to fractions.
6. Determine what percent one number is of another.
7. Estimate percents of a number.
8. Find a number when a percent of it is known.
9. Find what percent one number is of another.
10. Translate a word problem into one of the three types of percent problems.

Skills to be used

1. Explaining the thought process in writing or orally when given a problem-solving situation
2. Writing number sentences to aid in problem-solving
3. Checking for reasonableness of answers
4. Finding solution sets
5. Using the calculator

Workplace relationships

1. A movie theatre management wants to give students and senior citizens a special discount. Management can determine the price of the discount tickets based on the regular price.
2. A department store salesperson determines his/her total weekly salary based on the base salary plus a commission of total sales.
3. An auto mechanic is paid a commission on the service income he/she brings in each week.
4. A salesperson's goal for the week is used to determine percent accomplished and to compare last years sales with this year's sales.
5. A video store manager wants to mark up items and determines the percent of increase to make a particular profit.

Learning activities / Teaching strategies to use

1. Use calculators to practice changing from percents to decimals and fractions to percents.
2. Use computer lessons to practice changing number forms and to solve problems/applications.
3. Bring in ads or sale papers showing discounts.
4. Make lists of real situations using percents.
5. Use grid paper to make grids to model percents and show relationships with a written explanation.
6. Write a report on the origin of the word percent and discuss words in English language that are linked to percents.
7. Use a chart or spreadsheet in cooperative groups; write a list of problems and exchange them with other groups to be worked.

8. In groups, explain to each other the procedure to find percent of increase or decrease and explain procedure for changing fraction percents to fractions.

Evaluation (other than paper and pencil exams)

Students keep a chart which indicates percent of time spent in different activities.

Cooperative learning group members become a management team of a department store and decrease or increase price items before or after a sale; discuss percent of decrease and increase.

Students will write several problems, including word problems, to use in a class assignment test.

Resources:

WASATCH Computer Systems Lessons

CORD (Center for Occupational Research and Development) Unit B - Naming Numbers in Different Ways

Video by CORD COMMUNICATION

Mathematical Connections, Gardella et al., Houghton Mifflin

General Math Skills/Problem Solving, Gerardi et al., HBJ

Integrated Math I, Rubenstein, Grain, and Butts, Houghton Mifflin

Planning Group Members:

Deborah Abrahamson, Ruth Hairston, Cheryl Johnson, Rita Magee, and Patricia Presley

Unit name: **Ratio & Proportions** Suggested time: **2 weeks**

Objectives

Concepts to be learned Students will

Determine differences between ratio, unit rate, and proportion.
Use ratios and proportions to solve problems.
Use proportions to show direct and indirect relationships.
Determine similarity of geometric figures.
Solve percent problems using proportions.

Skills to be acquired Students will

Write ratios as fractions in lowest terms and find unit rates.
Write ratios, in simplified form using numbers with different units.
Determine the best buy for an item by using unit rate.
Determine whether proportions are true or not.
Use ratios or proportions to determine similarity of figures.
Interpret and use scale drawings to find actual measures.
Write the three types of percent problems as a proportion and solve.

Skills to be used

1. Explaining the thought process in writing or orally when given a problem-solving situation
2. Writing number sentences to aid in problem-solving
3. Checking for reasonableness of answers
4. Finding solution sets
5. Using the calculator

Workplace relationships

Architectural example:

Architects use ratio and proportions to make accurate models to show how their projects will look when completed.

Industrial Technology examples)

An industrial engineer observes assembly procedures to see if an operation can be improved by using an efficiency rating formula:

Efficiency Rating = (number of checks/number of observations) x 100

Checks indicate that work is being done.

Gears are frequently described with ratios. For example, a certain car's transmission and differential has a total gear reduction of 3.4:1. That is, the ratio of the crankshaft speed to the drive axle speed is 3.4 to 1. If the crankshaft in this car is turning at 1500 revolutions per minute (rpm), how fast would the drive axle by turning?

Business examples)

A restaurant manager uses the efficiency rating to determine if work is being done in an efficient manner.

Merchants find cost or selling price per unit for a quantity of units.

Cost = quantity x unit price

$C = n \times u$

West and Brown are partners. West invested $22,000 and Brown invested $48,000 in the business. They agree to split the first year profit of $89,600 in proportion to their initial investments.

a. What is the ratio of each partner's contributions to the total initial investment:

b. What portion of the total first-year profit should each partner receive?

General example:

A nut mix is to be prepared with cashews, almonds, and peanuts in the ration 1:1:3 by weight. Determine the ounces of almonds and peanuts needed if there are 8 ounces of cashews.

Health occupation example:

Red blood cells should account of 99.98% of all blood cells, with 0.02% accounting for all other cells.

a. What is the ratio of red cells to all other cells?
b. A blood analysis showed 4,600,000 red cells and 6000 other cells. Is this blood cell count close to normal? If not, is the other cell count higher or lower than normal?

During the first year of operation a clinic treated a total of 4836 patients, and gave 622 flu immunizations. This year the clinic is seeing many more patients. During the first six months the clinic has treated 3418, and given 481 flu immunizations.

a. What is the ratio of flu shots to patients seen during the first year of the clinic's operation? during the first six months of the second year?
b. Regarding the number of flu shots now being given, is the clinic giving proportionally the same number of shots, more shots, or fewer shots than the first year it was open?

Learning activities / Teaching strategies to use

1. View video, CORD Applied Mathematics, Unit 9 "Using Ratios and Proportions."
2. Use ratios to compare free throws made to the number of attempts for two basketball players or teams.
3. Practice writing ratios in simplified form.
4. Practice finding unit rates.
5. Go to a grocery store and find prices for different quantities of the same unit and make a list.
6. Create a computer spreadsheet or draw a chart to calculate or show unit prices by converting from one unit to another i.e. cost/kg; cost/lb.; cost/oz.
7. Interpret and use scale drawings.
8. Write ratios based on results of a class survey.
9. Use a calculator to test the equality of two ratios and the equivalence of two proportions.
10. Create a list of several proportions that are equivalent to a given proportion.
11. Solve open proportions for the missing term.
12. Explain the difference between ratio unit rate and proportion.
13. Compare and determine missing measures of corresponding sides in similar triangles.
14. Discuss, in written form, quantities that are directly or inversely proportional.
15. Using a map and its scale estimate distances by using proportions.
16. Solve percent problems by using proportions.
17. In cooperative groups, draw sets of rectangles similar to others and examine combinations of rectangles to see if sides are in proportion.
18. In cooperative groups, use a blueprint or model of a building, car, or airplane to discuss the scale used to make the model and calculate the real measurements of the full size object.

Evaluation (other than paper and pencil exams)

An efficiency rating will be done for each student, each week.
Students will compose problems to be used for a quiz or test. (Points will be assigned)
Students will keep a log of problems assigned for individual assignments or practice drills. (Points will be assigned.
Students in cooperative groups will determine best buy for item prices collected in the grocery store activity.
Students will make a scale drawing for a floor plan of a building, and give the scale ratio and scale dimensions.

Using specific given information, students will write a problem that could be solved by using a proportion.

Resources:

CORD, (Center for Occupational Research and Development), 1993
General Mathematics; Skills, Problem Solving, Applications, Gerardi, HBJ, 1982
Mathematical Connections, Gardella; Houghton Mifflin, 1992.
Essentials for High School Math, Cohen, Houghton Mifflin, 1989

Planning Group Members:

Deborah Abrahamson, Ruth Hairston, Cheryl Johnson, Rita Magee, and Patricia Presley

Unit name: **Introduction to Statistics** Suggested time: **2 weeks**

Objectives

Concepts to be learned

Recognize, define, and determine the various measures of central tendency (mean, median, mode) and range given a set of data.

Skills to be acquired

Given a set of data, determine the mean.
Given a set of data, determine the median.
Given a set of data, determine the mode.
Given a set of data, determine the range.
Given a set of data, make a frequency table.

Skills to be used

1. Explaining the thought process in writing or orally when given a problem-solving situation.
2. Writing number sentences to aid in problem-solving.
3. Checking for reasonableness of answers.
4. Finding solution sets.
5. Using the calculator.

Workplace relationships

Each person will do a workplace example related to their field:

Business example: As the owner of a small business, you have decided to provide your employees with health coverage. You are trying to choose which coverage will best suit your employees. You have asked your employees to fill out a brief questionnaire about the quality of an insurance company and its policy. One question asks the employees to rank their endorsement of the different policies on a scale of 1 (unsuitable) to 5 (very suitable) *Note* (Teachers and students compile own data.)

1. Make a tally frequency of the data.
2. Identify the mode of the data.
3. Compute the mean rating of the employees. Would the mean be a good way to summarize such ratings? Explain your answers.

Health occupation example: The drip rate of a patient's IV is changing depending on the position of the patient's arm. Over the course of a couple of hours, you count the num-ber of drops per minute several times. *Note* (Teachers and students compile own data.)

1. Using a tally, show a frequency distribution of the drip rates.
2. What are the values of the mean, mode, and median of the data?
3. What is the range of the data?

Industrial technology example: Your production line has begun a program of statistical process control. You must take five measurements of an assembled part each hour. You record your measurements as deviations from the specific dimension. Then you compare the mean and range of each set of measurements to a given limit to decide whether or not the production process is in control or out of control.

1. Determine the mean of the five measurements for each hour.
2. Determine the range of the five measurements for each hour.
3. The Quality Engineering Department sets up control limits for this process. To keep the settings of the machine under control, the mean must not exceed the + / - 0.25". To control the variability, the range must not exceed 0.5". Identify which of the hourly sets of measurements, if any, are "out of control."

Learning Activities / Teaching Strategies to use

1. Bring in grades for all classes (Determine average)
2. Video, CORD Applied Mathematics, Unit 19, "Working With Statistics"
3. Discussion, Introduction to terminology and applications
4. In a cooperative learning group, students will determine the mean, median, mode and range of their ages, height, blood pressure and pocket change.
5. In a cooperative learning group, each group will be given four test scores, and a grading scale. Assuming there are two tests left in the grading period, each group will determine what must be scored on the two tests to:
   a. Maintain the current grade.
   b. Raise the current grade to the next higher letter grade.
   c. Drop the current grade to the next lower letter grade.

Evaluation (other than paper and pencil exams)

Students will keep a record of the fat content of their diet during a week. They will separate the data by meal times and set up their own data. They must make a frequency table and determine the range, mean, median and mode of their fat intake for each meal for week. They must also determine the meal that has the most fat content. A written and oral report will be presented by each student.

Resources:

CORD (Center for Occupational Research and Development) Units & Video
General Mathematics: Skills, Problem Solving, Applications, Gerardi, et. al., HBJ
Integrated Mathematics I, Rubenstein, et. al., HBJ
Mathematical Connections, Gardella, et. al., Houghton Mifflin

Planning Group Members:

Deborah Abrahamson, Ruth Hairston, Cheryl Johnson, Rita Magee, and Patricia Presley

Unit name: **Introduction to Probability** Suggested time: **2 weeks**

Objectives

Concepts to be learned

Analyze and solve probability problems and predict outcomes from multiple events.

Skills to be acquired

1. Compute the probability of simple events.
2. Calculate the number of ways an event can happen.
3. Draw diagrams and charts to help determine a probability.
4. Use calculators to determine probabilities.
5. Determine the odds of an event.

Skills to be used

1. Explaining the thought process in writing or orally when given a problem-solving situation
2. Writing number sentences to aid in problem-solving
3. Checking for reasonableness of answers
4. Finding solution sets
5. Using the calculator

Workplace relationships

Business examples

A major credit card company uses 16-digit account numbers. The final digit of the number is a check digit so each account number is actually identified by 15 unique digits.

1. How many account numbers can be created?
2. Is this large enough to assign an account number to a specified population?

You need to schedule eight employees to work on three shifts. Each shift requires two workers.

1. How many possible ways are there to schedule these workers to these shifts? (Hint: Since there are two workers per shift, there are 6 positions to fill. But for each shift, it doesn't matter which of the two positions each worker occupies.)
2. Suppose that every three months you randomly schedule these workers to a new shift. You happen to know that two of the workers don't work well together--let's call them Worker A and Worker B. What is the probability that these two workers will be assigned to work the same shift?

Health occupation examples

Protective gloves are worn by medical personnel to reduce the risk of infection. Standards set for gloves used by medical personnel allow a failure rate of 2.5% for examination gloves and 1.5% for surgical gloves. Assume that the gloves discussed in this exercise have these maximum failure rates.

1. If you select one glove from a box of 25 surgical gloves, what is the probability of selecting a flawed glove? What if the box contains 50, 75, 100 etc. gloves?
2. If you use 25 examination gloves, what is the probability that none of them are flawed? (Hint: Find the probability {1st glove NOT flawed} and {2nd glove NOT flawed} AND...AND {25th glove NOT flawed}.)
3. If you use more gloves, you would expect the chances of getting a flawed glove to increase. The formula below allows you to determine the probability of getting just one flawed glove when you use N gloves.

$$\text{Problem } \{\text{One flawed glove out of N gloves}\} = N \times \text{Prob.}\{\text{Flawed glove}\} \times (\text{Prob.}\{\text{Glove not flawed}\})^{N-1}$$

Use the above formula to determine the probability of obtaining just one flawed examination glove when you use 25 gloves.

1. What is the probability of having no more than one flawed glove out of 25? (Hint: Find the probability of {1 glove flawed} OR {0 gloves flawed}.)

A geneticist uses probability to determine the chances of a child having the sickle cell trait. Have students construct a cross multiplication table of the above and answer the following questions:

1. What is the probability of a child having the sickle cell trait if only one parent has the trait?
2. What is the probability of a child having the sickle cell trait if both parents have the trait?

Industrial technology example:

A certain product is assembled in stages using three machines: Machine A, Machine B, and Machine C. During the previous 6 months, each of the machines has broken down, causing a slow-down in production while it was being repaired. Below is a table that shows the last 6 months' history.

Machine	Days operating	Days down for repair
A	116	16
B	106	26
C	122	10

1. For each machine, determine the observed probability of the machine being down on any given day.
2. If all machines are down at the same time, production must cease. Assuming that each machine's status is independent of the others, determine the probability that all three machines will be down at the same time.

Learning activities / Teaching strategies to use

Group hands-on experience - Hook Activity

From a bag(s) of flavored Starburst Candies, sort out the different colors and count.

Explain Probability - the ratio of the number of flavored outcomes to the total number of possible outcomes. Activity will calculate the probability of selecting each color as an independent event.

Sample Space

41 Orange
31 Yellow
19 Red
9 Pink

Independent Activity

1. Write the ratio of each color to the total number.
2. Calculate the percent of selecting a piece of candy of each color.
3. Each person draws a piece of candy and returns to container, then draws another piece and returns to container.
4. Each pull is recorded on the board.
5. After a number of times, compute percent and compare the actual outcomes with the probable outcomes.

Dependent Activity: What is the probability of pulling a red then a yellow without replacing the first one, etc. with all the colors?

Individual Assignment: Give each student a small bag of M&Ms. Have them

1. Determine the number of colors.
2. Determine the total number in each bag.
3. Determine the ratio of each color to the total number.

Merge into Cooperative Groups

1. Determine if each person has the same ratios for each color.
2. Assuming the ratio of color to the total in a small bag is the same as in a large bag, determine the number of each color found in a large bag of a specified number. (Teacher and students will determine the number.)

STUDENTS CAN EAT CANDIES UPON COMPLETION OF PROJECTS.

CORD Video, Unit 20 "Working with Probabilities"

Evaluation (other than paper and pencil exams)

Have students work in cooperative groups to create problems for which probabilities must be calculated. Each group should have materials available, such as colored squares of paper, chips, balls, etc. to demonstrate their problems to class.

Resources:

CORD (Center for Occupational Research and Development) Unit and Video
General Mathematics: Skills, Problem Solving, Applications, Gerardi, et. al., HBJ
Integrated Mathematics I, Rubenstein, et. al., HBJ
Mathematical Connections, Gardella, et. al., Houghton

Planning Group Members:

Deborah Abrahamson, Ruth Hairston, Cheryl Johnson, Rita Magee, and Patricia Presley

Unit name: **Formulas For Measuring Shapes of 2 and 3 Dimensions**
Suggested time: **3 weeks**

Objectives

Concept to be learned

Students will select and utilize formulas for determining measures of 2 and 3 dimensional shapes including the circle.

Skills to be acquired

Students will:

Demonstrate comprehension of a problem by determining given information and stating what is to be found.

Recognize and name different types of 2 and 3 dimensional figures.

Use correct units of measure for area, perimeter and volume.

Calculate area, perimeter circumference, volume surface area for quadrilaterals, parallelograms, circles, cylinders, rectangular solids and cones.

Solve problems that involve the different figures.

Skills to be used

1. Explaining the thought process in writing or orally when given a problem-solving situation.
2. Writing number sentences to aid in problem-solving.
3. Checking for reasonableness of answers.
4. Finding solution sets.
5. Using the calculator

Learning activities / Teaching strategies to use

1. Video, CORD Applied Mathematics, Unit 1 "Problem Solving," Unit 2 "Working with Shapes in 2 Dimensions," Unit 3 "Working with Shapes in 3 Dimensions."
2. Activities:

Use geoboard or dot paper to illustrate perimeter.

Use geoboard or dot paper to illustrate or determine area.

Calculate using traditional and non-traditional units of perimeter and area.

List real examples of different types of figures.

Use tangrams to explore area concepts.

Practice using formulas for volume and surface area.

Write a paragraph explaining the difference between perimeter and circumference.

While working in cooperative groups, bring in several circular objects of different sizes and make a chart determining circumference, diameter and their ratio and compare and discuss results.

Make models of 3-dimensional figures.

Practice using formulas for surface area and volume expressing answers as a rounded unit of measure.

While working in cooperative groups, take apart models to solve problems.

Workplace relationships

General example: A pile of sand dumped by a hopper is cone-shaped. The top of the pile is 8 1/2 feet. Above ground level the diameter of the base is 18 1/4 feet wide. Convert the measurements to yards and determine how many cubic yards of sand are in the pile.

Construction examples: The oil reservoirs of new engines require a specific number of quarts of oil. A mechanic can determine the number of gallons of oil needed to fill a particular number of engines and how many gallon drums will be needed.

A contractor has been asked to build a patio of a specified size. He will use concrete patio stones of a certain size. Given prices of a stone, how many stones should he buy? What will they cost?

Business examples: Knowing the size of a square tile, and the number in a box, a home improvement salesperson can determine the number of square tiles needed, and the number of boxes to cover a floor with specific dimensions.

A professional painter can determine the surface area and number of gallons of paint to be used for painting cylindrical columns in a shopping mall.

Business example: Marilyn is the department manager for Ayres carpeting. She is helping her cousin shop for carpeting for the living room that measures 14 ft. by 16 ft. Marilyn is trying to help her cousin decide between two choices:

1. Area rug that is 12 ft. by 15 ft. at a given price.
2. Wall to wall carpet in a similar color and design that sells for $26.50 per square yard installed. Which would cost less?

Health occupation examples: A retirement home physical therapist can determine the number of times and how far a patient needs to walk around a circular garden by knowing the diameter of the garden.

What amount of oxygen should be mixed with hydrogen (10%) and nitrogen (10%) for a patient with high need for oxygen (80% as opposed to 10%) where 500 c.c. of air have to be prepared?

Evaluation (other than paper and pencil exams)

Students will list examples of real 2-dimensional shapes and bring in physical examples of different 3-dimensional shapes (Points will be given for items brought in).

As a cooperative assignment, students will determine the amount and cost of materials needed to paint and carpet the classroom. They will use current ads or determine which stores would be used for the best prices. A report will be written including all the procedures.

Given a particular area in the building, students will determine the dimensions for perimeter and area and calculate (i.e., bulletin board, locker, volume of wastepaper can.)

As a homework assignment, students will have to find the area, perimeter/ circumference of an object in their home. A report will be written including all the dimensions and procedures.

Resources:

CORD (Center for Occupational Research and Development) Units
General Mathematics: Skills, Problem Solving, Applications, Gerardi, et. al., HBJ
Integrated Mathematics I, Rubenstein, et. al., HBJ
Mathematical Connections, Gardella, et, al., Houghton Mifflin

Planning Group Members:

Deborah Abrahamson, Ruth Hairston, Cheryl Johnson, Rita Magee, and Patricia Presley